



US006531377B2

(12) **United States Patent**
Knorr et al.

(10) Patent No.: **US 6,531,377 B2**
(45) Date of Patent: **Mar. 11, 2003**

(54) **METHOD FOR HIGH ASPECT RATIO GAP
FILL USING SEQUENTIAL HDP-CVD**

(75) Inventors: **Andreas Knorr**, Fishkill, NY (US);
Mihel Seltz, Wappingers Falls, NY
(US)

(73) Assignee: **Infineon Technologies AG**, Munich
(DE)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/904,799**

(22) Filed: **Jul. 13, 2001**

(65) **Prior Publication Data**

US 2003/0013271 A1 Jan. 16, 2003

(51) Int. Cl.⁷ **H01L 21/00**

(52) U.S. Cl. **438/435; 438/424**

(58) Field of Search **438/637, 243,**
438/244, 248, 435, 221, 424, 685, 694,
427, 437, 689, 696, 758, 762; 257/304,
306, 311

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,930,107 A * 7/1999 Rajeevakumar 257/302

6,191,004 B1 * 2/2001 Hsiao 438/435
6,236,079 B1 * 5/2001 Nitayama et al. 257/304
6,294,423 B1 * 9/2001 Malik et al. 438/241
6,300,219 B1 * 10/2001 Doan et al. 438/424
6,319,796 B1 * 10/2001 Laparra et al. 438/435
6,335,239 B1 * 1/2002 Agahi et al. 438/245
6,335,261 B1 * 1/2002 Natzel et al. 438/435
6,335,288 B1 * 1/2002 Kwan et al. 438/694
6,339,241 B1 * 1/2002 Mandelman et al. 257/301
6,346,457 B1 * 2/2002 Kawano 438/424
6,365,523 B1 * 4/2002 Jang et al. 438/692
6,368,912 B1 * 4/2002 Chang et al. 438/248

* cited by examiner

Primary Examiner—David Nelms

Assistant Examiner—David Vu

(74) *Attorney, Agent, or Firm*—Slater & Matsil, L.L.P.

(57) **ABSTRACT**

A method of providing isolation between element regions of a semiconductor memory device (200). Isolation trenches (211) are filled using several sequential anisotropic insulating material (216/226/230) HPD-CVD deposition processes, with each deposition process being followed by an isotropic etch back to remove the insulating material (216/226/230) from the isolation trench (211) sidewalls. A nitride liner (225) may be deposited after isolation trench (211) formation. A top portion of the nitride liner (225) may be removed prior to the deposition of the top insulating material (230) layer.

23 Claims, 6 Drawing Sheets

